

# MCP361 | Assignment 7

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## 1 Protocol for Storing and Reading the Data

### 1.1 Protocol for Storing the Data

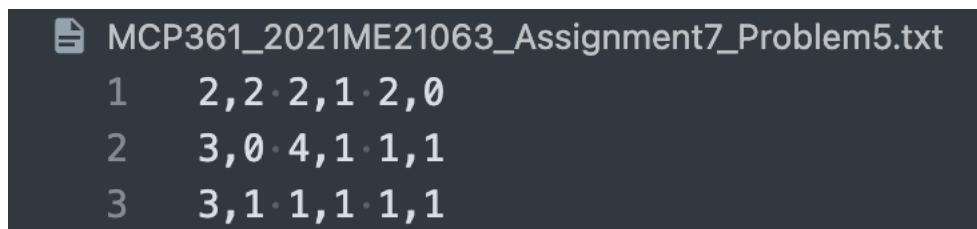
The game matrix is represented in the text file with the following conventions:

- Each row in the file corresponds to a row in the payoff matrix.
- Each entry in the row consists of a pair of integers representing the payoffs for Player 1 and Player 2.
- The payoff pairs are written as comma-separated integers, like this: P1,P2, with no spaces between the numbers or commas.
- Each pair is separated by a space from the next pair in the same row.

For example, consider the following payoff matrix for a two-player game:

	Strategy 1	Strategy 2
Strategy 1	(10, 8)	(2, 2)
Strategy 2	(0, 0)	(8, 10)

This matrix would be stored in the text file as follows:



```
MCP361_2021ME21063_Assignment7_Problem5.txt
1 2,2 2,1 2,0
2 3,0 4,1 1,1
3 3,1 1,1 1,1
```

Figure 1: Input File Format

### 1.2 Protocol for Reading the Data

To read the data from this file, the following steps should be performed:

1. Open the file and read it line by line.
2. Split each line by spaces to get the payoff pairs.

3. Split each payoff pair by a comma (',') to extract the individual payoffs for Player 1 and Player 2.
4. Convert the extracted values to integers and store them as tuples.

### 1.3 Algorithm to Read the Data

The following algorithm outlines the process for reading the payoff matrix from a file:

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**Algorithm 1** Read Payoff Matrix from File

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```

1: procedure READ_GAME_FROM_FILE(filename)
2:   Initialize an empty list game_matrix
3:   Open the file filename in read mode
4:   for each line in the file do
5:     Strip leading and trailing whitespace from the line
6:     Split the line by spaces to get a list of payoff pairs
7:     Initialize an empty list row
8:     for each payoff pair in the list do
9:       Split the pair by the comma to extract P1 and P2
10:      Convert P1 and P2 to integers
11:      Append the tuple (P1, P2) to row
12:    end for
13:    Append row to game_matrix
14:  end for
15:  Return game_matrix
16: end procedure

```

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## 2 Nash Equilibrium for the Given Payoff Matrix

The payoff matrix for the question 5 two-player game is given as follows:

	Strategy 1	Strategy 2	Strategy 3
Strategy 1	(2, 2)	(2, 1)	(2, 0)
Strategy 2	(3, 0)	(4, 1)	(1, 1)
Strategy 3	(3, 1)	(1, 1)	(1, 1)

### 2.1 Step-by-Step Derivation

We will find the best responses for both players and determine the Nash equilibrium.

#### 2.1.1 Player 1's Best Responses

Player 1 wants to maximize their payoff, given Player 2's strategy:

- If Player 2 plays Strategy 1, Player 1's payoffs are:

(2, 2) from Strategy 1,  
 (3, 0) from Strategy 2,  
 (3, 1) from Strategy 3.

**Best response for Player 1:** Strategy 2 (payoff 3).

- If Player 2 plays Strategy 2, Player 1's payoffs are:

(2, 1) from Strategy 1,  
(4, 1) from Strategy 2,  
(1, 1) from Strategy 3.

**Best response for Player 1:** Strategy 2 (payoff 4).

- If Player 2 plays Strategy 3, Player 1's payoffs are:

(2, 0) from Strategy 1,  
(1, 1) from Strategy 2,  
(1, 1) from Strategy 3.

**Best response for Player 1:** Strategy 1 (payoff 2).

### 2.1.2 Player 2's Best Responses

Player 2 wants to maximize their payoff, given Player 1's strategy:

- If Player 1 plays Strategy 1, Player 2's payoffs are:

(2, 2) from Strategy 1,  
(2, 1) from Strategy 2,  
(2, 0) from Strategy 3.

**Best response for Player 2:** Strategy 1 (payoff 2).

- If Player 1 plays Strategy 2, Player 2's payoffs are:

(3, 0) from Strategy 1,  
(4, 1) from Strategy 2,  
(1, 1) from Strategy 3.

**Best response for Player 2:** Strategy 2 (payoff 1).

- If Player 1 plays Strategy 3, Player 2's payoffs are:

(3, 1) from Strategy 1,  
(1, 1) from Strategy 2,  
(1, 1) from Strategy 3.

**Best response for Player 2:** Strategy 1 (payoff 1).

## 2.2 Nash Equilibria

We find that there are two Nash equilibria, where both players play their best responses simultaneously:

- Player 1 chooses Strategy 2 and Player 2 chooses Strategy 2: Payoff: (4, 1)
- Player 1 chooses Strategy 3 and Player 2 chooses Strategy 1: Payoff: (3, 1)

The Nash equilibria are:

Player 1 chooses Strategy 2 and Player 2 chooses Strategy 2
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Player 1 chooses Strategy 3 and Player 2 chooses Strategy 1
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### 3 Results of all the Problems

```
sanchit@sanchits-MacBook-Air-32:~/Sanchit/Semester 7/MCL361/MCP361_2021...
MCP361_2021ME21063_Assignment7_Problem1.txt
-----
Player 1 chooses strategy 1 and Player 2 chooses strategy 1
Player 1 chooses strategy 2 and Player 2 chooses strategy 2
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MCP361_2021ME21063_Assignment7_Problem2.txt
-----
Player 1 chooses strategy 2 and Player 2 chooses strategy 2
-----

MCP361_2021ME21063_Assignment7_Problem3.txt
-----
No Nash Equilibrium identified.
-----

MCP361_2021ME21063_Assignment7_Problem4.txt
-----
Player 1 chooses strategy 1 and Player 2 chooses strategy 2
Player 1 chooses strategy 1 and Player 2 chooses strategy 3
Player 1 chooses strategy 2 and Player 2 chooses strategy 1
Player 1 chooses strategy 3 and Player 2 chooses strategy 1
Player 1 chooses strategy 4 and Player 2 chooses strategy 4
Player 1 chooses strategy 5 and Player 2 chooses strategy 5
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MCP361_2021ME21063_Assignment7_Problem5.txt
-----
Player 1 chooses strategy 2 and Player 2 chooses strategy 2
Player 1 chooses strategy 3 and Player 2 chooses strategy 1
-----

MCP361_2021ME21063_Assignment7_Problem6.txt
-----
Player 1 chooses strategy 1 and Player 2 chooses strategy 4
-----
```

Figure 2: Results